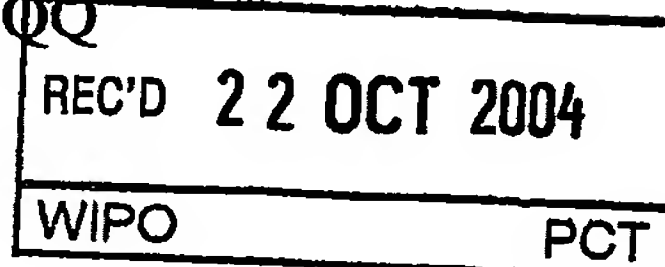




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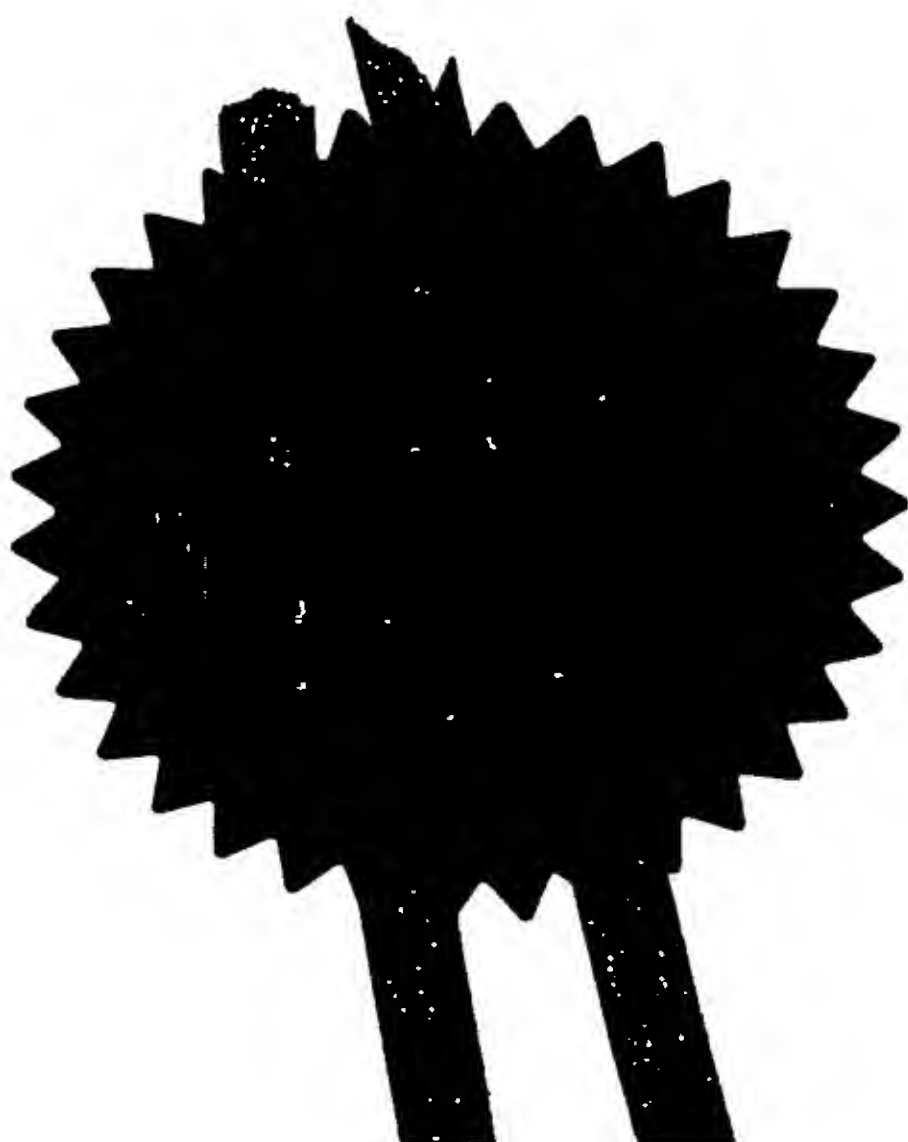


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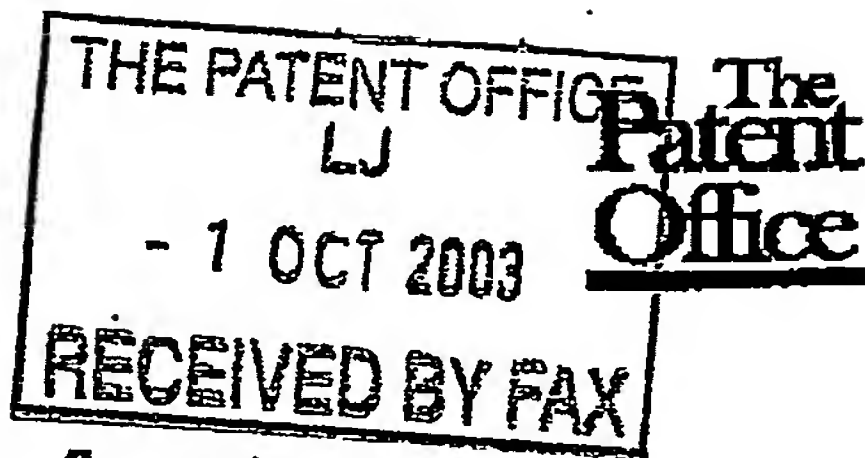
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Dated 5 October 2004

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P01/7700 0.00-0322966.3

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The Patent Office

Cardiff Road
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NP9 1RH

1. Your reference

57.0598 GB NP

2. Patent application number

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0322966.3

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Schlumberger Holdings Limited

PO Box 71
Craigmuir Chambers
Road Town, Tortola
British Virgin Islands

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

British Virgin Islands

7236326001

4. Title of the invention

SYSTEM AND METHOD FOR CORRECTING ERRORS IN DEPTH FOR MEASUREMENTS MADE WHILE DRILLING

5. Name of your agent (if you have one)

William L. WANG

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Schlumberger Cambridge Research Limited
High Cross
Maddingley Road
Cambridge CB3 0EL
UK

Patents ADP number (if you know it)

7626161001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

USA

10/330,634

27/12/2002

USA

10/400,125

26/03/2003

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

YES

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
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Patents Form 1/77

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Description 6

Claim(s) 2

Abstract 1

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Statement of inventorship and right to grant of a patent (Patents Form 7/77) -

Request for preliminary examination and search (Patents Form 8/77) 1

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Any other documents -
(please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Date

1 Oct 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

William L. WANG,
01223 325268

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DUPLICATE

SYSTEM AND METHOD FOR CORRECTING ERRORS IN DEPTH FOR
MEASUREMENTS MADE WHILE DRILLING

FIELD OF THE INVENTION:

5 The present invention relates to the field of
measurements made during the drilling phase of a
hydrocarbon borehole. In particular, the invention
relates to an automated method for correcting errors in
depth for such measurements.

10

BACKGROUND OF THE INVENTION:

 During the drilling phase of the construction
of a hydrocarbon wellbore, the length of the drillstring
15 in the borehole is used to estimate the measured depth
(or along hole length) of a borehole, it is assumed that
the pipe is inelastic and therefore does not stretch.
However, discrepancies in the length of the borehole
estimated at surface during rig operations and the actual
20 length of the borehole there may cause gaps or lost data,
when the uncorrected depth is used with logs of data
measured during with sensors mounted on the drillstring,
such as LWD and MWD logs.

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SUMMARY OF THE INVENTION:

 According to the invention a method is provided
for automatically correcting for depth errors in
30 measurements taken from a drillstring comprising the
steps of receiving data representing measurements taken
in a hydrocarbon wellbore at a plurality of depths within

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BRIEF DESCRIPTION OF THE DRAWINGS:

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correction according to a preferred embodiment of the

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DETAILED DESCRIPTION OF THE INVENTION:

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frictional forces due to contact with the borehole acting along the length of the drillstring. Two of these parameters, friction factor and weight on bit vary depending on the rig operation and the drillers input at surface. According to the invention, a method is provided for correcting the measurement of depth at surface for these parameters. The corrected depth is then used to assign depths to data measured downhole.

10 Figure 1 shows a scheme for correcting depth for measurements made from a drillstring according to a preferred embodiment of the invention. According to a preferred embodiment of the invention the following steps are undertaken for each time step:

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1) The drillstring description, dimensions pipe weight per unit length are input, the pipe length as measured at surface is updated from real-time measurements.

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2) The borehole trajectory, inclination and azimuth are input and updated from downhole measurements in real-time.

3) The rig operation is computed preferably as described in co-pending US Patent Application Serial No. 10/400,125 entitled "System and Method for Rig State Detection," filed on 26 March 2003, which is a continuation-in-part of co-pending US Patent Application Serial No. 10/330,634 filed on 27 December 2002. Both of these applications are hereby incorporated herein by reference.

30

4) A model for computing the stress in the drillstring is given the operation is selected.

5) A friction factor is selected for the given rig state.

6) Weight on bit is either estimated from the hookload and total hookload or from weight on bit measured downhole.

7) From these inputs the model is used to compute the hookload. If the hookload is within tolerances equal to the measured hookload the stress profile is accepted and used to compute the pipe stretch. If it is not then the friction factor or the weight on bit are varied until the hookload and the calculated hookloads match. The models used here and in step 4 above preferably known models such as Drillsafe™.

8) Pipe stretch is then computed using the stress profile.

9) The stretch correction is applied to measured depth to give the corrected depth and time stamped.

10) Time stamped downhole data is the associated with the corrected surface measured depths with the same time stamp.

Figure 2 shows an example of data prior to correction according to a preferred embodiment of the invention. The first frame of Figure 2 shows a surface time verse depth plot, the first section is drilling without surface rotation. As a result all of the friction force is opposing the motion of the drillstring along the hole. As a result whilst drilling the direction of the friction force is towards surface. The driller then stops drill pulls the drillstring off bottom and then runs back to bottom rotating the drillstring, when rotating the

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according to a preferred embodiment of the invention.

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disclosure. Accordingly, the exemplary embodiments of the invention set forth above are considered to be illustrative and not limiting. Various changes to the described embodiments may be made without departing from
5 the spirit and scope of the invention.

CLAIMS

What is claimed is:

- 5 1. A method for automatically correcting for depth errors in measurements taken from a drillstring comprising the steps of:
- receiving data representing measurements taken
 in a hydrocarbon wellbore at a plurality of depths
10 within the wellbore from at least one sensor located on a drillstring used to drill the wellbore;
 automatically calculating corrections for errors in the depth of the locations; and
 making use of the measured data having the
15 depths corrected.
2. A method according to claim 1 wherein the step of automatically calculating the corrections is based at

least in part on the state of a drilling rig used to
20 support the drillstring at the times when the measurements are taken.
3. A method according to claim 1 wherein further comprising the step of measuring the length of portions
25 of the drillstring prior to insertion into the wellbore.
4. A method according to claim 3 wherein a time versus depth log is constructed using at least the measured length of portions of the drillstring.
30.
5. A method according to claim 4 wherein the calculated corrections is applied to time versus depth

log to generate a corrected time versus depth log, and wherein the corrected time versus depth log is combined with the data representing measurements taken in the wellbore such that a corrected depth can be attributed to
5 said measurements.

6. A method according to claim 1 wherein said step of calculating corrections is based in part on estimates of stretch of the length of the drillstring.

10

ABSTRACT

A method and system is disclosed for automatically correcting for depth errors in measurements taken from a drillstring during the drilling phase of the construction of a hydrocarbon wellbore. The correction is based on a stress profile which in turn is based on the the states of the drilling rig, drill string description length spec, borehole description trajectory, friction factor and weight on bit.

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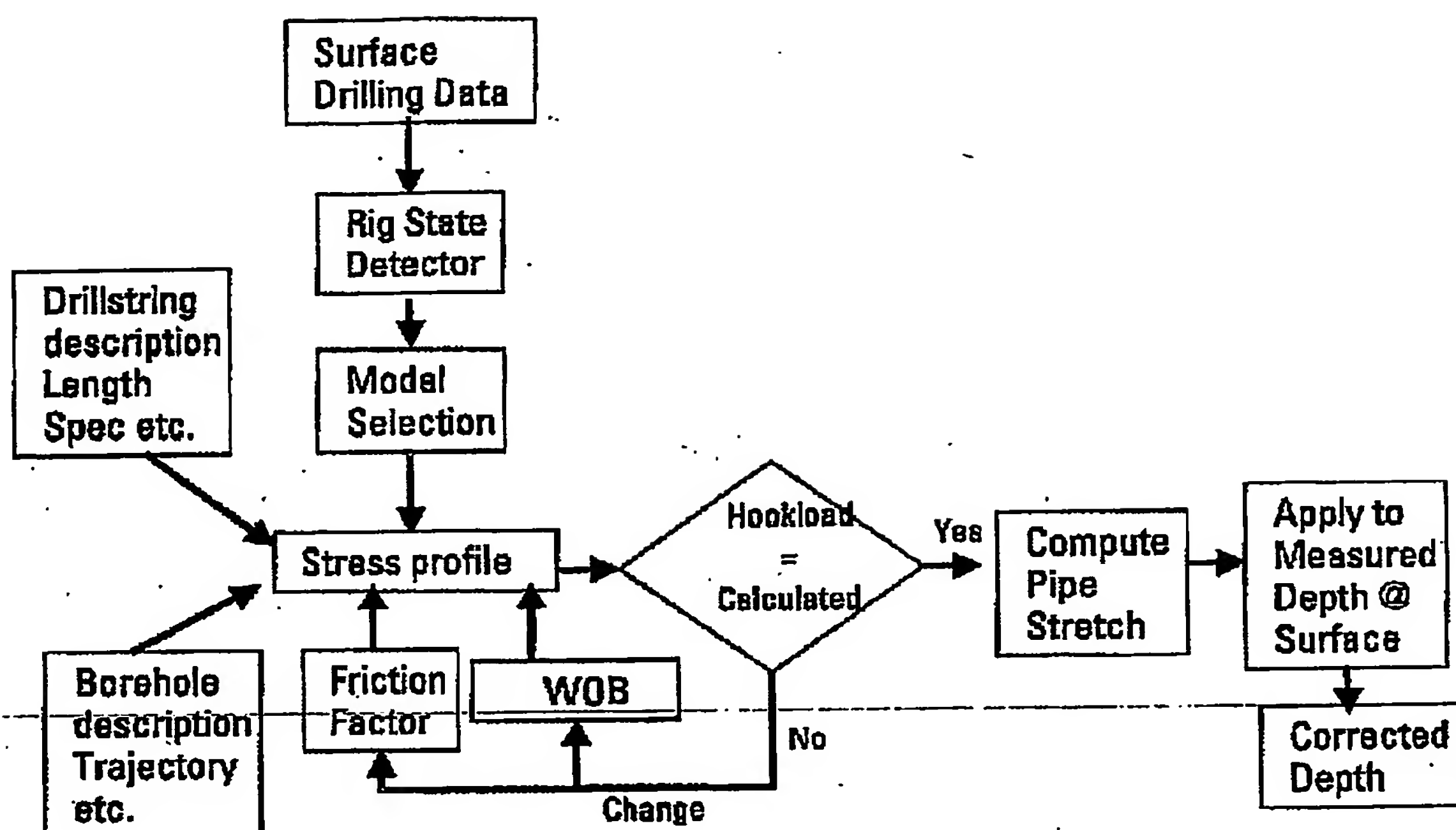


Figure 1

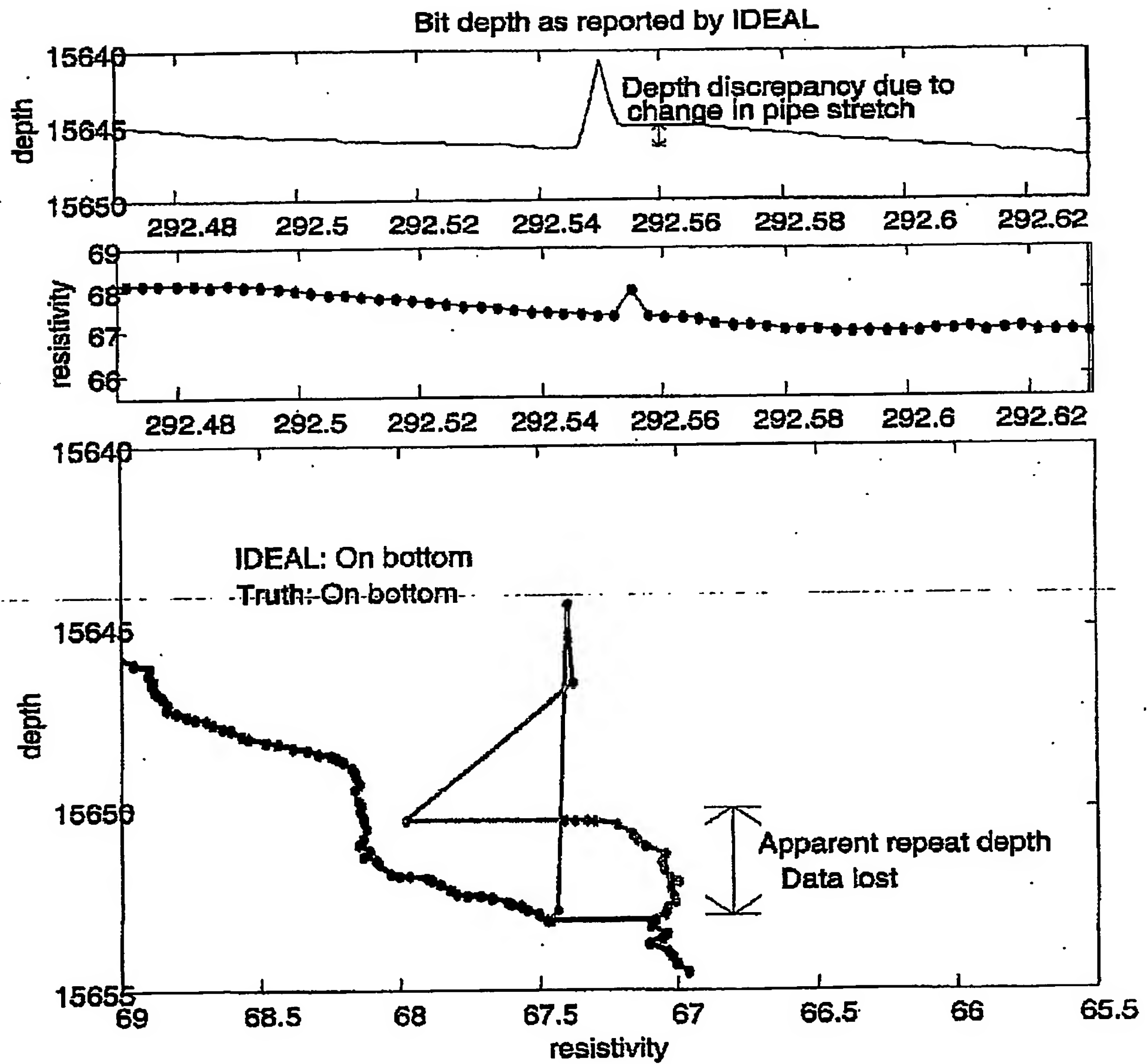


Figure 2

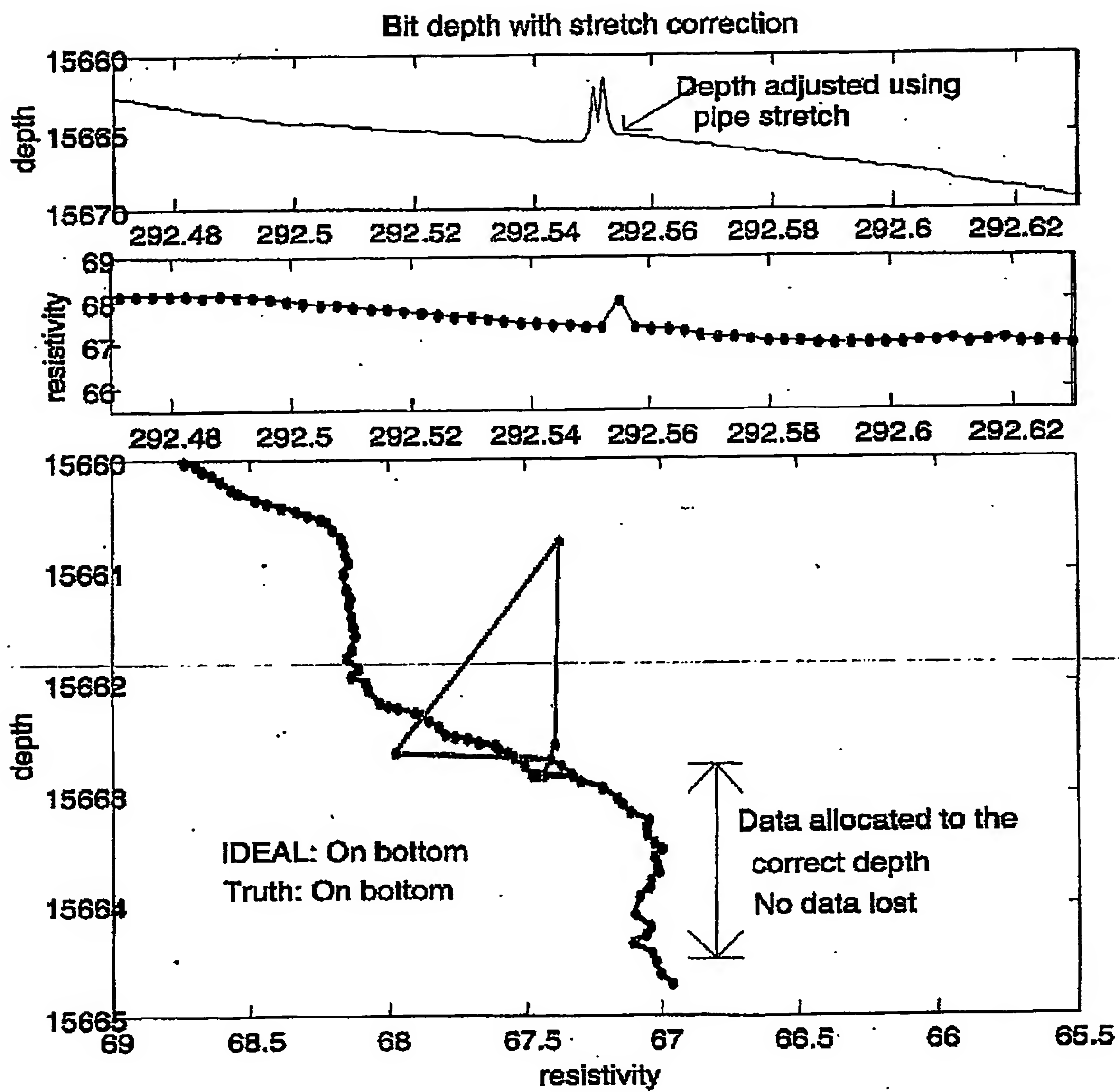


Figure 3

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